

# UNCLASSIFIED

FY 2000 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1999

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N

PROGRAM ELEMENT TITLE: Defense Research Sciences

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1998 ACTUAL	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Ocean Sciences	126,061	138,576	144,282	149,851	150,747	153,662	157,168	160,788	CONT.	CONT.
Advanced Materials	54,655	59,881	62,875	66,019	67,009	68,349	69,716	71,110	CONT.	CONT.
Information Sciences	40,194	45,100	47,355	49,723	50,469	51,983	53,542	55,148	CONT.	CONT.
Sustaining Programs	97,266	103,279	106,606	109,463	109,073	110,599	112,943	115,384	CONT.	CONT.
TOTAL	318,176	346,836	361,118	375,056	377,298	384,593	393,369	402,430	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program sustains U.S. naval scientific and technological superiority, provides new concepts and technological options for the maintenance of naval power and national security, and provides the means to avoid scientific surprise, while exploiting scientific breakthroughs. The program responds to the science and technology (S&T) requirements from the Department of the Navy (DON) Joint Mission Areas/Joint Support Areas (JMA/SA) and enables the technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. It also seeks to exploit new science opportunities relevant to long term naval requirements. The Office of Naval Research (ONR) responds to requirements through major research thrusts in Ocean Sciences, Advanced Materials, Information Sciences, and the Sustaining Programs. These efforts are part of an integrated DON S&T process initiated in 1993.

(U) This program responds to the Strike JMA through research leading to better structural materials to increase platform survivability; automated target recognition algorithms to improve identification of friend or foe (IFF), and to help improve real-time targeting under camouflage conditions; and physics and chemistry foundations for improved multispectral, all-weather

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sensors and electronics. Responses to the Innovation in Naval Warfare/Engagement and Littoral Warfare JMAs, which cover forward operations in high-threat coastal regions, involve knowledge of near-shore ocean and atmospheric circulation, remote sensing, acoustics, and optical transmission to improve mine detection and removal, special operations capabilities and submarine detection; novel structural materials for better ship damage tolerance; data fusion research to integrate environmental prediction products into Command, Control, Communications, Computers & Information Warfare (C4/IW) systems; and new concepts in batteries and propellants for improved torpedo performance. The program responds to requirements in the Intelligence/Surveillance/Reconnaissance JMA with research into advanced materials for improved sensors and electronics; better signal processing for automated target recognition allowing rapid ship self-defense and identifying relocatable targets; ocean and atmospheric properties, allowing sensors to operate more effectively under highly variable (battlespace) environmental conditions; and network and data studies to address real-time, all-weather surveillance and targeting, with short revisit times using multiple high capacity data links. Research into improved aerodynamic shapes for high endurance surveillance responds directly to a requirement of the Nuclear Deterrence Counterproliferation of Weapons of Mass Destruction (NDC/WMD) JMA. Research in response to the Readiness and Support/Infrastructure SAs includes developing knowledge of acoustic/boundary interactions for improved navigation capabilities in poorly charted areas; exploring longer service life materials for reduced logistics; and investigating chemical and biological processes for clean handling of shipboard waste. Finally, cognitive research leading to more efficient and cost-effective training, to more user-compatible decision support systems, and to principles for the design of reconfigurable command and control structures responds to the Manpower & Personnel and Training SAs.

(U) Program response to affordability requirements includes research on condition based maintenance, embedded training, manufacturing science, antifouling coatings, advanced materials and coatings, biosensors, and electro-optical and multifunctional electronic devices and concepts that promise to greatly simplify future undersea surveillance arrays and radar systems while reducing life cycle cost.

(U) Due to the sheer volume of efforts included in this program element, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this program element.

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(U) The Navy S&T program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under Basic Research because it encompasses scientific study and experimentation directed toward increasing knowledge and understanding in broad fields directly related to long-term DON needs.

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(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1998 ACCOMPLISHMENTS:

- (U) (\$126,061) Ocean Sciences responded to Littoral Warfare requirements by undertaking experiments to identify and understand processes unique to marginal and semi-enclosed seas (e.g., Red Sea, Mediterranean, Okhotsk, and Persian Gulf) to support higher resolution environmental nowcasts/forecasts, improved mine drift prediction, and improved acoustic/nonacoustic antisubmarine warfare environmental information; and by continuing development of advanced models coupled to remote sensor observations for higher resolution, improved coastal waves prediction.
- (U) (\$54,655) Advanced Materials responded to Innovation in Naval Warfare/Engagement requirements through investigations into improved materials for airframes and radomes; and to requirements for Support/Infrastructure SA through exploration of thermal spray nanoscale coatings for wear, corrosion, and thermal barrier applications. Reflects Congressional plus-up for Molecular Design Institute (\$8M).
- (U) (\$40,194) Information Sciences responded to Strike requirements through investigation of H-Infinity waves leading to improved computational models for increased efficiency of shipboard electromagnetics (EM) design, increased efficiency of shipboard EM systems, and reduction/control of ship's EM signature. It responded to Strategic Mobility through development of mathematical and computational tools for analysis, estimation, and prediction of oceanographic and meteorological environmental conditions on the regional scale.
- (U) (\$97,266) Sustaining Programs responded to Strike requirements by investigating techniques for radio frequency (RF) clutter suppression for ship defense and missile seekers, and multi-spectral sensors/data fusion in support of avionics and weapons. They responded to C4/IW requirements through exploring potentially simpler and more robust spin-injected electron devices for: magnetic sensors and magneto-optics; non-volatile memory for satellites, missiles, and mobile communication units; high-speed, low-power switches; low-power digital electronics such as memory elements; and phased-array radar antenna elements.

(U) FY 1999 PLAN:

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- (U) (\$138,576) Ocean Sciences will respond to Intelligence/Surveillance/Reconnaissance requirements through investigating predictability in the ocean and atmosphere, examining sensitivities to initial and boundary conditions in order to develop improved strategies for targeting observations from deployable sensor systems; and to Strike requirements through continuing biodynamic sensing/processing effort using signals from two precisely located sensors to improve detection/classification/localization of submarines with low/no Doppler effects.
- (U) (\$59,881) Advanced Materials will respond to Support/Infrastructure SA requirements through new understanding of affordable composite technology for naval structures gained from exploration of methods to characterize composites for their use in various designs; and through sub-grid modeling to characterize small scale structural phenomena leading to new material properties. It will respond to Strike requirements through continued studies of improved energetic materials to achieve higher lethality with reduced weight.
- (U) (\$45,100) Information Sciences will respond to Strike requirements by exploring adaptive non-linear control for integrated flight propulsion avionics, and to Support/Infrastructure SA requirements by investigating the applications of chaos theory to nonlinear control of cranes, and tools for adaptive intelligent systems, such as autonomous agents and unmanned vehicles.
- (U) (\$97,497) Sustaining Programs will respond to Support/Infrastructure requirements through hybrid modeling analysis of genetic logic to yield control of shipboard processes, including bioreactors/biomaterials and (responding also to NDC/WMD requirements) rapid, rational identification of molecular targets for therapeutic interventions against old and new chemical biological defense (CBD) agents.
- (U) (\$5,782) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.

(U) FY 2000 PLAN:

- (U) (\$144,282) Ocean Sciences will respond to Littoral Warfare requirements by developing more reliable coastal predictive models for battlespace environments, evaluating the linkages of small scale to large scale oceanic processes, and exploring environmentally adaptive systems for quantifying the role of the environment on ship

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systems in order to improve the probability of success of military operations conducted from coastal regions of the sea. It will also respond to Sea & Air Superiority requirements by exploring in-situ measurement and sonar adaptation to specific environments for significantly improved ASW performance, automatic target recognition methods for ultra-low false alarm rate periscope detection radar, wake detection sensors, and theater-level data fusion for cooperative ASW.

- (U) (\$62,875) Advanced Materials will respond to Sea & Air Superiority requirements by developing low signature materials for autonomous robotic systems supporting Naval Special Warfare and Explosive Ordnance Disposal, and unique biomaterials for improved infrared (IR)/acoustic sensors. It will respond to C4/IW through advanced lithography, wide bandgap heterojunctions, and large area, wide bandgap materials for multifunctional wide bandwidth systems with high linearity, efficiency and power.
- (U) (\$47,355) Information Sciences will respond to Intelligence/Surveillance/Reconnaissance requirements by seeking the theoretical basis for high-performance man-machine multi-mode multi-media interface semi-autonomous systems for decision aids, optimal management of dynamic tactical and computer networks, and methods for automated defensive information warfare. It will respond to Support/Infrastructure SA requirements by research on virtual sensors and battery charger analyzer for improved maintenance, diagnostics and testing of naval machinery.
- (U) (\$106,606) Sustaining Programs will respond to Sea & Air Superiority requirements by exploring integrated ship propulsion concepts for higher hydrodynamic efficiency, prediction models of damaged ship motions/loads for damage control and improved maneuvering/seakeeping, and by developing active and passive signature control concepts with compatible shock reduction technology and reduced weight, volume and cost impact for submarines. They will respond to Strike requirements by exploring new concepts for torpedo silencing, and by designing high power thermal systems for half-length and supercavitating weapons propulsion.

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B. (U) PROGRAM CHANGE SUMMARY:

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
FY 1999 President's Budget	324,495	347,945	364,159
Appropriated Value		347,945	
Adjustments from FY 1999 PRESBUDG	-6,319	-1,109	-3,041
FY 2000 President's Budget Submission	318,176	346,836	361,118

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1998 adjustments reflect a Small Business Innovative Research reduction (-\$6,086), Federal Technology Transfer (-\$22), and an Actual Update Adjustment (-\$211). FY 1999 adjustments reflect Revised Economic Assumptions (-\$801), Civilian Personnel Underexecution (-\$301), and FFRDC distribution (-\$7). FY 2000 adjustments reflect a Program Balance Adjustment (-\$1,348), a Civilian Pay Rate Adjustment (+\$876), a Diesel Fuel Adjustment (-\$5), Non Pay Inflation (-\$5,220), and Navy Working Capital Fund Rate adjustment (+2,656).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601102A Defense Research Sciences (Army)

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(U) PE 0601102F Defense Research Sciences (Air Force)  
(U) PE 0601152N In-House Laboratory Independent Research  
(U) PE 0602111N Air and Surface Launched Weapons Technology  
(U) PE 0602121N Ship, Submarine and Logistics Technology  
(U) PE 0602122N Aircraft Technology  
(U) PE 0602234N Materials, Electronics and Computer Technology  
(U) PE 0602314N Undersea Warfare Surveillance Technology  
(U) PE 0603207N Air/Ocean Tactical Applications  
(U) PE 0603785N Combat Systems Oceanographic Performance Assessment

Activities are coordinated through Defense S&T 6.1 Reliance Scientific Planning Groups.

D. (U) SCHEDULE PROFILE: Not applicable.

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